WHAT IS CLAIMED IS:

1. A method of forming an aluminum structure in a microelectronic article, the method comprising:

forming a recess in a microelectronic substrate;

forming a metal-containing layer conforming to a surface of the recess and to an adjacent surface of the substrate;

plasma treating the substrate having the metal-containing layer thereon; and

depositing aluminum on the metal-containing layer to form an aluminum layer thereon.

2. The method of Claim 1, wherein depositing aluminum comprises depositing the aluminum at a temperature of about 160 °C or less.

3. The method of Claim 1, wherein forming a recess comprises forming a contact hole in an insulating layer of the substrate that exposes an underlying conductive region of the substrate.

4. The method of Claim 1, wherein the recess has an aspect ratio greater than about 1.

5. The method of Claim 1, wherein forming a metal-containing layer comprises forming the metal-containing layer by metal organic chemical vapor deposition (MOCVD).

6. The method of Claim 5, wherein the metal-containing layer is a barrier metal layer.

7. The method of Claim 6, wherein the metal-containing layer comprises at least one material selected from a group consisting of titanium nitride (TiN), tantalum nitride (TaN), titanium silicon nitride (TiSiN) and tantalum silicon nitride (TaSiN).

8. The method of Claim 1, wherein depositing aluminum comprises depositing aluminum on the metal-containing layer by chemical vapor deposition (CVD) using a methylpyrrolidine alane (MPA) source gas.

9. The method of Claim 1, wherein plasma treating the substrate comprises plasma treating using at least one gas selected from a group consisting of argon (Ar), hydrogen (H_2), nitrogen (N_2), oxygen (O_2), nitrous oxide (N_2O) and ammonia (NH_3).

10. The method of Claim 1, wherein plasma treating the substrate comprises plasma treating the substrate at a pressure in a range from about 1 Torr to about 6 Torr.

11. The method of Claim 1, wherein plasma treating the substrate comprises plasma treating the substrate at a power level in a range from about 600 W to about 1,000 W.

12. The method of Claim 1, wherein plasma treating the substrate comprises plasma treating the substrate for about 60 seconds.

13. The method of Claim 1:

wherein forming a metal-containing layer is preceded by forming an ohmic layer conforming to an interior surface of the recess and to the adjacent surface of the insulating layer; and

wherein forming a metal-containing layer comprises forming the metal-containing layer on the ohmic layer.

14. The method of Claim 13, wherein the ohmic layer comprises at least one of titanium (Ti) or tantalum (Ta).

15. The method of Claim 1:

wherein forming a metal-containing layer comprises forming a first metal-containing layer;

wherein plasma treating comprises plasma treating the substrate having the first metal-containing layer thereon;

wherein depositing aluminum on the metal-containing layer comprises depositing aluminum on the first metal-containing layer to form a first aluminum layer thereon; and

wherein the method further comprises:

forming a second metal-containing layer conforming to an interior surface of the recess and to an adjacent surface of the insulating layer;

plasma treating the substrate having the second metal-containing layer thereon; and

depositing aluminum on the second metal-containing layer at a temperature of about 160 °C or less to form a second aluminum layer thereon.

16. The method of Claim 1, wherein depositing aluminum comprises depositing aluminum by CVD until the recess is filled.

17. The method of Claim 1, wherein depositing aluminum comprises:

depositing aluminum by CVD to form a seed aluminum layer in the recess; and

sputter depositing aluminum on the seed aluminum layer in the recess; and

wherein the method further comprises reflowing the deposited aluminum in the recess.

18. The method of Claim 1, wherein plasma treating the substrate comprises plasma treating the substrate under conditions sufficient to cause aluminum to deposit at a greater rate on a portion of the metal-containing layer within the recess than on a portion of the metal-containing layer adjacent the recess.

19. The method of Claim 1, wherein the recess comprises one of a hole, a trench, a groove or a step.

20. A method of forming an aluminum structure in a microelectronic article, the method comprising:

forming a recess in a microelectronic substrate;

forming a metal-containing layer that conforms to an inner surface of the recess and to a surface of the substrate adjacent the recess;

decreasing a carbon concentration in a portion of the metal-containing layer on the surface of the substrate adjacent the recess in comparison to a portion of the metal-containing layer within the recess; and

depositing aluminum on the metal-containing layer to form an aluminum layer that conforms to the inner surface of the recess and to the surface of the substrate adjacent the recess.

21. The method of Claim 20, wherein decreasing a carbon concentration comprises plasma-treating the substrate having the metal-containing layer thereon.

22. The method of Claim 21, wherein plasma treating the substrate comprises plasma treating the substrate with at least one gas selected from a group consisting of argon (Ar), hydrogen (H_2), nitrogen (N_2), oxygen (O_2), nitrous oxide (N_2O) and ammonia (NH_3) at a pressure in a range from about 1 Torr to about 6 Torr and a power level in a range from about 600 W to about 1,000 W.

23. The method of Claim 21, wherein plasma treating the substrate comprises plasma treating the substrate with at least one gas selected from a group consisting of argon (Ar), hydrogen (H_2), nitrogen (N_2), oxygen (O_2), nitrous oxide (N_2O) and ammonia (NH_3) at a pressure in a range from about 1 Torr to about 6 Torr and a power level in a range from about 600 W to about 1,000 W for a duration of about 60 seconds.

24. The method of Claim 20, wherein decreasing a carbon concentration in a portion of the metal-containing layer on the surface of the substrate adjacent the recess in comparison to a portion of the metal-containing layer within the recess comprises creating a difference in carbon concentration between the portion of the metal-containing layer on the surface of the substrate adjacent the recess and the portion of the metal-containing layer within the recess sufficient to cause aluminum to deposited at a greater rate on the portion of the metal-containing layer within the recess than on the portion of the metal-containing layer on the surface of the substrate adjacent the recess.

25. The method of Claim 20, wherein forming a metal-containing layer comprises depositing a layer comprising at least one of Ta and Ti using a metal organic source gas.

26. The method of Claim 20, wherein depositing aluminum comprises depositing aluminum on the metal-containing layer using a CVD process with an MPA source gas.

27. The method of Claim 26, wherein depositing aluminum comprises depositing aluminum on the metal-containing layer using an MPA source gas at a temperature of about 160 °C or less.

28. The method of Claim 20, wherein the recess comprises one of a hole, a trench, a groove or a step.

29. A microelectronic article of manufacture, comprising:

a substrate having a recess herein; and

a metal-containing layer on the substrate that conforms to an inner surface of the recess and to a surface of the substrate adjacent the recess, wherein the metal-containing layer has a substantially higher concentration of carbon in a portion of the metal-containing layer in the recess than in a portion of the metal-containing layer on the surface of the substrate adjacent the recess.

30. The microelectronic article of manufacture of Claim 29, wherein the metal-containing layer comprises at least one of Ta and Ti.

31. The microelectronic article of manufacture according to Claim 29, wherein the concentration of carbon in the portion of the metal-containing layer in the recess is sufficiently higher that the carbon concentration in the portion of the metal-containing layer on the surface of the substrate adjacent the recess to cause aluminum to deposit more rapidly on the portion of the metal-containing layer in the recess that on the portion of the metal-containing layer on the surface of the substrate adjacent the recess in an CVD process using an MPA source gas.